Homework 4

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José Carlos Muñoz

1

The original 1D data set is

$$\begin{bmatrix} 2 & 1 & 3 & 4 & 7 \end{bmatrix}$$

The filter we are using is

$$\begin{bmatrix} 1 & 0 & 1 \end{bmatrix}$$

Using the convolution the math looks like this

$$2 * 1 + 1 * 0 + 3 * 1 = 5$$
$$1 * 1 + 3 * 0 + 4 * 1 = 5$$
$$3 * 1 + 4 * 0 + 7 * 1 = 10$$

Therefore, the final matrix will be

$$\begin{bmatrix} 5 & 5 & 10 \end{bmatrix}$$

4

7

The 7x7 matrix is

$$\begin{bmatrix} 6 & 3 & 4 & 4 & 5 & 0 & 3 \\ 4 & 7 & 4 & 0 & 4 & 0 & 4 \\ 7 & 0 & 2 & 3 & 4 & 5 & 2 \\ 3 & 7 & 5 & 0 & 3 & 0 & 7 \\ 5 & 8 & 1 & 2 & 5 & 4 & 2 \\ 8 & 0 & 1 & 0 & 6 & 0 & 0 \\ 6 & 4 & 1 & 3 & 0 & 4 & 5 \end{bmatrix}$$

The 3x3 matrix

$$\begin{bmatrix} 1 & 1 & 1 \\ 0 & 0 & 0 \\ -1 & -1 & -1 \end{bmatrix}$$

Using the convolution the math looks like this, only the first 3 columns of the first row of the new matrix will be calculated

$$4 = 6 * 1 + 3 * 1 + 4 * 1 + 4 * 0 + 7 * 0 + 4 * 0 + 7 * -1 + 0 * -1 + 2 * -1$$
$$3 = 3 * 1 + 4 * 1 + 4 * 1 + 7 * 0 + 4 * 0 + 0 * 0 + 0 * -1 + 2 * -1 + 3 * -1$$
$$4 = 4 * 1 + 4 * 1 + 5 * 1 + 4 * 0 + 0 * 0 + 4 * 0 + 2 * -1 + 3 * -1 + 4 * -1$$

The final convolution matrix is

$$\begin{bmatrix} 4 & 3 & 4 & -3 & -3 \\ 0 & -1 & 0 & 1 & -2 \\ -5 & -6 & 1 & -1 & 0 \\ 6 & 11 & 1 & -3 & 1 \\ 3 & 3 & 4 & 4 & 2 \end{bmatrix}$$